



# Saffire Offgas Testing Strategy

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# Saffire (Spacecraft Fire Experiment)



- Designed to conduct a large-scale low gravity fire safety experiment
  - Experiment will be located on Orbital Science Corporations' Cygnus re-supply vehicle after it un-berths from the ISS and prior to de-orbit.
- There are 3 Saffire units
  - Identical hardware except for sample card
  - Saffire-I and Saffire-III sample size and material will be identical.
  - Saffire-II will contain 9 separate samples of various materials on one card.





# Test Plan



- Schedule was critical, so a test plan was developed to expedite testing, with minimal number of tests, to give results for all three units.
- Offgas Tests:
  1. Entire Saffire-III unit (Flight), with sample material and sample card inside, but without Zotek foam (T-value known).
  2. Saffire-II representative samples (9 materials) tested as 1 component (non-flight).
  3. Retest of entire Saffire-III unit if initial test fails. Initial test (#1) will be considered a bakeout.
  4. Retest of Saffire-II representative samples if initial test fails. Initial test (#2) will be considered a bakeout.
  5. Representative material for Saffire-I and Saffire-III, if Saffire-II fails.





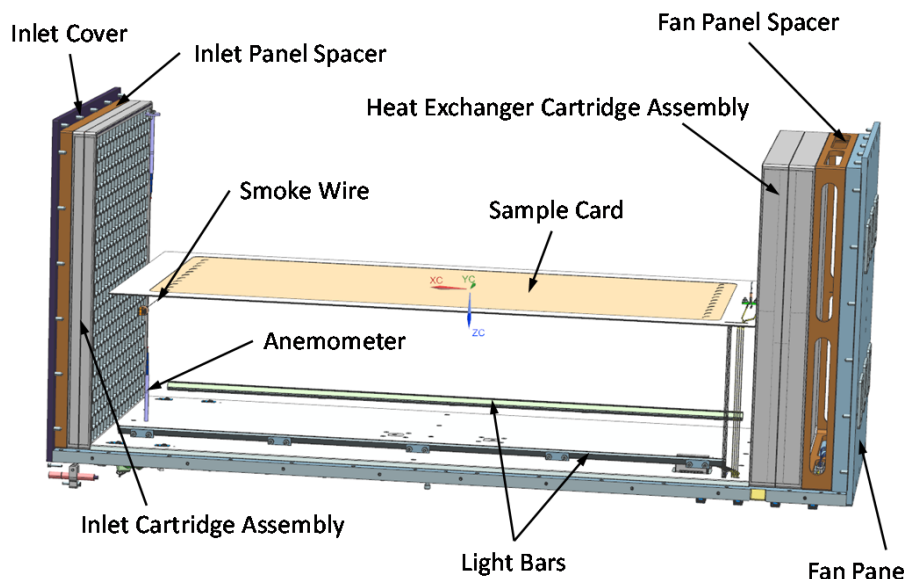
# T-Value Calculation by Unit



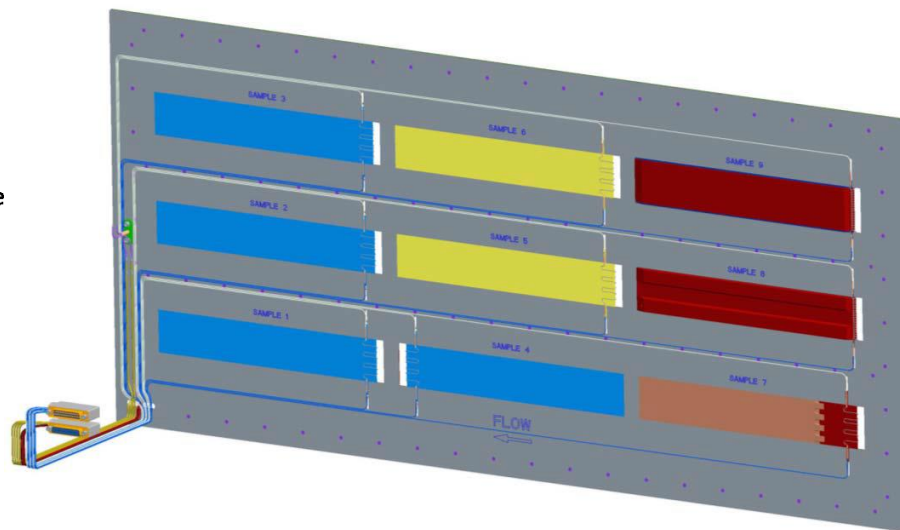
- The T-Value for each individual Saffire unit will be calculated by adding or subtracting the T-Value of the individual offgas tests from the test plan.

Offgas Test T-Value	Saffire-I	Saffire-II	Saffire-III
Saffire-III Flight Unit	Added	Added	Added
Saffire-II Materials	N/A	Added	N/A
Saffire-I/III Material	N/A	Subtracted (if necessary)	N/A
Zotek Foam (previously tested)	Added	Added	Added





Saffire I and III Internal Configuration  
with Sample Card



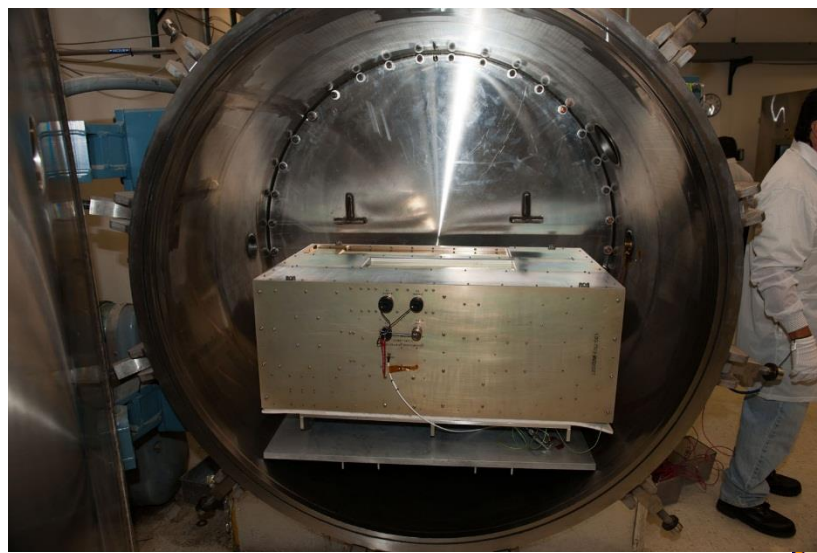
Saffire II Sample Card



# Saffire-III Flight Unit Test

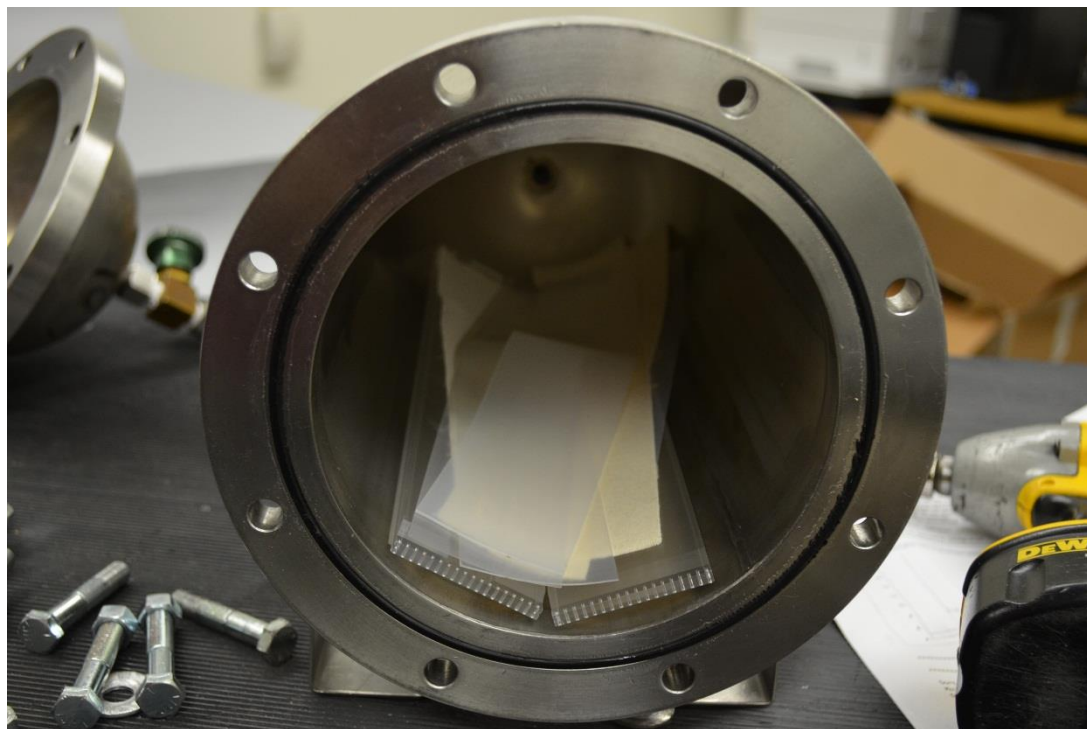


- Largest chamber at WSTF was used to accommodate the unit's size and weight (critical lift).
- Zotek foam (for protection during testing) and grounding strap (unit is ESD sensitive) were required to be inside the offgas chamber.
  - Zotek foam piece and grounding strap were baked at 120 °F for 4 days prior to Saffire-III unit test to reduce their effect on the Saffire-III toxic rating.
  - Zotek foam piece and grounding strap would be offgas tested afterward, if needed to reduce toxic rating (was not required).





- Standard Test 7 (non-flight)
- Samples were sent earlier than the Saffire-III unit
  - WSTF was able to complete the interpretation and give the preliminary results to the customers while they were onsite for the Saffire-III test.





# Test Results Summary



## Test Plan Offgas Tests:

1. Entire Saffire-III unit (Flight), with sample material and sample card inside, but without Zotek foam (T-value known).  
**Test successful, T-Value result acceptable. No retest required.**
2. Saffire-II representative samples (9 materials) tested as 1 component (non-flight). **Test successful, T-Value result acceptable. No retest required.**
3. Retest of entire Saffire-III unit if initial test fails. Initial test (#1) will be considered a bakeout. **NOT REQUIRED**
4. Retest of Saffire-II representative samples if initial test fails. Initial test (#2) will be considered a bakeout. **NOT REQUIRED**
5. Representative material for Saffire-I and Saffire-III, if Saffire-II fails. **NOT REQUIRED**







# International Offgas Round Robin Status & Results

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# RR Design Goals

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- Examine Laboratory GS Analytical Performance and Repeatability
  - Gas Standards B & D
- Examine Laboratory Calibration Effects
  - Gas Standard A
- Examine Laboratories Identification and Quantification Performance
  - Material
- Examine Aging Effects and Variation
  - Return of all materials & GS to WSTF





# GS-A, B and D Results



## GS-B and GS-D Results with In-House Calibration Methods

<b>Component Name</b>	<b>Conc. (ppmv)</b>	Lab A		Lab B		Lab C		Lab D	
		Avg Conc. (ppmv)	RPD	Avg Conc. (ppmv)	RPD	Avg Conc. (ppmv)	RPD	Avg Conc. (ppmv)	RPD
Vinyl Chloride	10.3	10.88	5.67	10.2	0.97	9.79	4.98		
Acetonitrile	12.1	11.93	1.44	10.2	15.70	12.39	2.37		
Furan	10.2	6.87	32.60	6.95	31.86	8.11	20.52		
Benzene	4.1	3.93	4.09	3.75	8.46	4.21	2.68		
Formaldehyde	0.98-1.20	0.823	31.45	0.538	48.30	0.56	49.58	1.00	2.04

## GS-B Results with GS-A Calibration Standard

<b>Component Name</b>	<b>Conc. (ppmv)</b>	Lab A		Lab B		Lab C		Lab D	
		Avg Conc. (ppmv)	RPD	Avg Conc. (ppmv)	RPD	Avg Conc. (ppmv)	RPD	Avg Conc. (ppmv)	RPD
Vinyl Chloride	10.3	10.00	2.93	10.5	1.94	10.71	4.01	10.47	1.62
Acetonitrile	12.1	10.73	11.36	11.5	4.68	13.34	10.22	11.57	4.41
Furan	10.2	7.00	31.40	7.30	28.40	7.60	25.46	7.43	27.12
Benzene	4.1	3.94	3.86	3.95	3.74	4.09	0.16	3.97	3.25



# Lab A Material Results

Component	#1 µg/g	#2 µg/g	#3 µg/g
Propylene	0.007173	0.006024	0.006314
Chloromethane	0.02756	0.019699	0.024566
Acetaldehyde	0.070653	0.044302	0.04441
Butene	0.010102	0.005645	0.003376
Methyl alcohol	4.82885	4.370322	4.748874
Chloroethane	0.051616	0.034513	0.026753
Ethyl alcohol	0.037749	0.034627	0.044385
Trace Unidentified Component	X	X	tr
Acetone	0.116472	0.089702	0.071108
Propionaldehyde	0.009598	0.003467	0.004939
1-Pentene	0.017816	tr	X
Trace Unidentified Component	tr	tr	tr
Isopropyl alcohol	0.030323	0.006707	0.022955
t-Butyl alcohol	0.164376	0.125258	0.196955
1-Chloropropane	0.062099	0.012521	0.046531
Trace Unidentified Component	tr	X	X
Metyl vinyl ketone	0.008498	0.003745	0.006763
Trimethyl silanol	0.067833	0.055556	0.105899
Butyraldehyde	0.010206	0.00193	0.004685
2-Methyl-2-propenenitrile	0.117244	0.124838	0.158167
Methyl ethyl ketone	0.067735	0.046458	0.044226
1-Hexene	0.005801	X	tr
2-Methylpropanenitrile	0.243961	0.209223	0.278941
Ethyl acetate	0.104559	0.070919	0.126082
1-Chlorobutane	0.014995	0.005458	0.007535
3-Methyl-2-butanone	0.027776	0.015168	0.022674
Benzene	0.007564	0.0067	0.005922
3-Methyl-3-buten-2-one	0.015542	tr	tr
Unidentified component	0.016569	tr	tr
Pentanal	0.013406	tr	0.006185
Hexamethyldisiloxane	0.017836	X	X
1-Heptene	0.004935	tr	X





# Lab A Material Results Continued

Component	#1 µg/g	#2 µg/g	#3 µg/g
2,4,4-Trimethyl-1-pentene	0.019617	0.00936	0.010558
Methyl isobutyl ketone	0.007423	0.00641	tr
C6 Ketone	tr	0.006097	tr
1-Chloropentane	0.010981	0.012962	0.013933
Trace Unidentified Component	tr	X	X
Toluene	0.008646	0.015997	0.018049
n-Hexanal	0.006629	X	X
Trace Unidentified Component	tr	X	X
Unidentified component	0.021296	0.02269	0.025812
Trace Unidentified Component	tr	tr	tr
Hexamethylcyclotrisiloxane	1.042681	0.752897	1.084252
Trace Unidentified Component	X	tr	X
Trace Unidentified Component	X	tr	tr
Unidentified component	X	0.042777	0.049318
Unidentified components	tr	0.087823	0.09745
C10-C11 Saturated aliphatic hydrocarbons	0.95761	1.615928	1.776793
Unidentified components	0.087627	0.110123	0.122735
Octamethylcyclotetrasiloxane	2.216331	1.790635	1.596577
Unidentified component	0.14151	0.153845	0.107149
C8 Alcohol	0.384959	0.379447	0.33313
Unidentified component	tr	0.087678	0.087279
Methyl benzoate	0.0521	0.184404	0.077144
Unidentified component	0.15464	0.184198	0.262001
C10 Esters	0.88047	1.452459	1.536928
Trace Unidentified Component	X	tr	tr
Trace Unidentified Component	tr	tr	tr
Trace Unidentified Component	tr	tr	tr
C11 Esters	0.536422	0.791644	0.693563
Trace Unidentified Component	tr	tr	tr
Trace Unidentified Component	tr	tr	tr
Formaldehyde	0.001879	0.006652	0.002348
Carbonyl sulfide	0.007139	0.000391	0.001174
Carbon disulfide	0.00238	0.004461	0.003469
Carbon monoxide	0.07244	0.097367	0.037447





# Lab B Material Results



Adhesive tape Component Name (Identified)	1 <sup>st</sup> Conc.(ppm)	2 <sup>nd</sup> Conc.(ppm)	3 <sup>rd</sup> Conc.(ppm)	RSD (%)
C7 alcohol	0.021	0.023	0.014	24.4
C8 alcohols	0.195	0.215	0.208	4.93
Ethyl alcohol	0.146	0.163	0.129	11.6
Isopropyl alcohol	0.052	0.050	0.038	16.2
Methyl alcohol	24.0	24.1	22.9	2.81
<u>tert-Butyl alcohol</u>	0.448	0.447	0.430	2.29
Acetaldehyde	0.272	0.292	0.255	6.78
<u>Butyraldehyde</u>	0.040	0.042	0.039	3.79
C8 aldehyde	0.016	0.017	0.017	3.46
<u>Valeraldehyde</u>	0.022	0.024	0.021	6.84
Toluene	0.036	0.037	0.035	2.78
C10 ester	0.120	0.132	0.131	5.22
C11 esters	0.163	0.190	0.203	11.0
Ethyl acetate	0.070	0.067	0.067	2.55
Methyl benzoate	0.101	0.101	0.103	1.14
C10 saturated aliphatic hydrocarbons	0.053	0.058	0.050	7.53
C11 saturated aliphatic hydrocarbons	0.272	0.276	0.260	3.09
C11 unsaturated aliphatic hydrocarbons	0.047	0.050	0.038	13.9
C12 unsaturated aliphatic hydrocarbons	0.175	0.173	0.182	2.67
C13 saturated aliphatic hydrocarbon	0.011	0.014	0.015	15.6
C13 unsaturated aliphatic hydrocarbons	0.018	0.021	0.029	25.1
C4 unsaturated aliphatic hydrocarbon	0.026	0.023	0.021	10.8
C8 unsaturated aliphatic hydrocarbon	0.010	0.013	0.010	15.7
Cyclohexane	0.041	0.044	0.035	11.5
Propylene	0.027	0.026	0.027	2.17
2-Butanone	0.035	0.041	0.038	7.89
Acetone	0.334	0.347	0.327	3.02
C8 nitrile	0.161	0.173	0.160	4.39
<u>Isobutyronitrile</u>	0.232	0.229	0.215	4.03
<u>Methacrylonitrile</u>	0.214	0.221	0.218	1.61
Carbon monoxide	0.409	0.423	0.411	1.83
<u>Hexamethylcyclotrisiloxane</u>	0.430	0.441	0.428	1.62
<u>Octamethylcyclotetrasiloxane</u>	0.282	0.305	0.280	4.81
<u>Trimethylsilanol</u>	0.065	0.070	0.073	5.83
APRSD				3.51%





# Lab B Material Results Continued

Adhesive tape Component Name ( Unidentified and trace)	1st Conc.(ppm)	2nd Conc.(ppm)	3rd Conc.(ppm)
n-Butyl alcohol	N/A	< 0.019	N/A
Acrolein	< 0.034	< 0.034	N/A
Benzaldehyde	< 0.011	< 0.011	N/A
C8 aldehyde	< 0.010	< 0.010	< 0.010
Formaldehyde	< 0.100	< 0.100	< 0.100
Hexylaldehyde	N/A	N/A	< 0.014
Isobutyraldehyde	N/A	< 0.023	N/A
Methyl acetate	< 0.040	< 0.040	N/A
Methyl formate	N/A	< 0.089	N/A
C8 ether	N/A	< 0.010	< 0.010
Butyl chloride	< 0.017	< 0.017	< 0.017
Chloroethane	< 0.034	< 0.034	< 0.034
Isopropyl chloride	< 0.023	< 0.023	< 0.023
C10 saturated aliphatic hydrocarbon	< 0.007	< 0.007	N/A
C10 saturated aliphatic hydrocarbon	< 0.007	< 0.007	N/A
C10 saturated aliphatic hydrocarbon	< 0.007	< 0.007	N/A
C10 saturated aliphatic hydrocarbon	< 0.007	< 0.007	N/A
C10 unsaturated aliphatic hydrocarbon	< 0.007	< 0.007	N/A
C10 unsaturated aliphatic hydrocarbon	N/A	< 0.007	N/A
C12 saturated aliphatic hydrocarbon	N/A	N/A	< 0.006
C12 unsaturated aliphatic hydrocarbon	< 0.006	< 0.006	< 0.006
C12 unsaturated aliphatic hydrocarbon	< 0.006	< 0.006	0.007
C13 saturated aliphatic hydrocarbon	N/A	N/A	< 0.005
C13 saturated aliphatic hydrocarbon	N/A	< 0.005	N/A
C5 unsaturated aliphatic hydrocarbon	< 0.014	< 0.014	N/A
cis-2-Butene	< 0.017	N/A	N/A
Ethylene	< 0.034	< 0.034	< 0.034
n-Hexane	< 0.011	< 0.011	N/A
n-Pentane	N/A	< 0.014	N/A
Undecane	0.009	< 0.006	0.008
3-Buten-2-one	< 0.023	0.026	0.025
C6 ketone	N/A	N/A	< 0.014
C7 ketone	< 0.011	N/A	N/A
Unknown_1	< 0.014	< 0.014	N/A



# Lab B Material Results Continued

Adhesive tape Component Name (Identified)	1st Conc.(ppm)	2nd Conc.(ppm)	3rd Conc.(ppm)	RSD (%)
C7 alcohol	0.034	0.037	0.034	4.95
C8 alcohols	0.272	0.343	0.295	11.9
Ethyl alcohol	0.170	0.153	0.179	7.89
Isopropyl alcohol	0.031	0.035	0.040	12.8
Methyl alcohol	27.1	26.9	25.6	3.07
tert-Butyl alcohol	0.596	0.585	0.565	2.70
Acetaldehyde	0.188	0.222	0.184	10.5
Benzaldehyde	0.020	0.023	0.021	7.16
C8 aldehydes	0.052	0.057	0.048	8.62
Valeraldehyde	0.016	0.016	0.016	0.000
Toluene	0.054	0.052	0.047	7.07
C10 ester	0.250	0.320	0.262	13.5
C11 esters	0.260	0.393	0.302	21.4
Ethyl acetate	0.111	0.112	0.114	1.36
Methyl benzoate	0.292	0.267	0.237	10.4
C10 saturated aliphatic hydrocarbons	0.138	0.145	0.125	7.46
C10 unsaturated aliphatic hydrocarbon	0.008	0.008	0.007	7.53
C11 saturated aliphatic hydrocarbons	0.750	0.661	0.609	10.6
C11 unsaturated aliphatic hydrocarbons	0.087	0.082	0.074	8.10
C12 unsaturated aliphatic hydrocarbons	0.533	0.552	0.487	6.38
C13 saturated aliphatic hydrocarbon	0.020	0.030	0.025	20.0
C13 unsaturated aliphatic hydrocarbons	0.065	0.104	0.095	23.2
C8 unsaturated aliphatic hydrocarbon	0.010	0.013	0.011	13.5
Cyclohexane	0.041	0.062	0.060	21.3
Undecane	0.043	0.025	0.022	37.9
2-Butanone	0.034	0.039	0.030	13.1
Acetone	0.211	0.245	0.234	7.54
C8 nitrile	0.233	0.266	0.239	7.15
Isobutyronitrile	0.295	0.293	0.279	3.02
Methacrylonitrile	0.356	0.365	0.346	2.67
Carbon monoxide	0.292	0.318	0.310	4.34
Hexamethylcyclotrisiloxane	0.329	0.333	0.319	2.21
Octamethylcyclotetrasiloxane	0.359	0.415	0.359	8.56
Trimethylsilanol	0.092	0.082	0.085	5.94
Unknown_9	0.02	0.017	0.015	14.5
APRSD				5.19%



# Lab B Material Results Continued

Adhesive tape Component Name ( Unidentified and trace)	1st Conc.(ppm)	2nd Conc.(ppm)	3rd Conc.(ppm)
n-Butyl alcohol	N/A	< 0.018	N/A
n-Propyl alcohol	< 0.025	N/A	< 0.025
Acrolein	N/A	N/A	< 0.031
Formaldehyde	< 0.100	< 0.100	< 0.100
Methyl acetate	< 0.037	N/A	< 0.037
C8 ether	N/A	< 0.009	< 0.009
Butyl chloride	< 0.016	< 0.016	0.016
Chloroethane	N/A	N/A	< 0.031
C10 saturated aliphatic hydrocarbon	N/A	< 0.006	< 0.006
C10 saturated aliphatic hydrocarbon	0.008	0.007	< 0.006
C10 unsaturated aliphatic hydrocarbon	< 0.006	< 0.006	< 0.006
C11 unsaturated aliphatic hydrocarbon	0.006	< 0.006	< 0.006
C12 saturated aliphatic hydrocarbon	< 0.005	< 0.005	< 0.005
C13 saturated aliphatic hydrocarbon	N/A	< 0.005	< 0.005
C13 saturated aliphatic hydrocarbon	< 0.005	< 0.005	< 0.005
C13 saturated aliphatic hydrocarbon	N/A	< 0.005	N/A
C13 saturated aliphatic hydrocarbon	N/A	0.005	< 0.005
C14 saturated aliphatic hydrocarbon	N/A	< 0.004	< 0.004
C15 unsaturated aliphatic hydrocarbon	N/A	< 0.004	N/A
C4 unsaturated aliphatic hydrocarbon	< 0.016	< 0.016	< 0.016
n-Hexane	< 0.010	< 0.010	N/A
Propylene	< 0.021	< 0.021	< 0.021
3-Buten-2-one	0.028	< 0.021	< 0.021
C7 ketone	0.013	< 0.010	0.013
Unknown_1	N/A	N/A	< 0.012
Unknown_2	N/A	N/A	< 0.012
Unknown_3	N/A	N/A	< 0.012
Unknown_4	N/A	N/A	< 0.012
Unknown_5	N/A	N/A	< 0.012
Unknown_6	< 0.012	N/A	N/A
Unknown_7	N/A	N/A	< 0.012
Unknown_8	0.013	< 0.012	< 0.012
Unknown_10	< 0.012	0.014	< 0.012
Unknown_11	< 0.012	N/A	N/A



# Lab B Material Results Continued

Adhesive tape Component Name (Identified)	1st Conc.(ppm)	2nd Conc.(ppm)	3rd Conc.(ppm)	RSD (%)
C7 alcohol	0.032	0.030	0.032	3.69
C8 alcohols	0.245	0.259	0.276	5.97
Ethyl alcohol	0.148	0.109	0.127	15.2
Isopropyl alcohol	0.036	0.044	0.039	10.2
Methyl alcohol	28.1	25.2	26.7	5.44
tert-Butyl alcohol	0.589	0.521	0.547	6.21
Acetaldehyde	0.192	0.181	0.230	12.8
Benzaldehyde	0.016	0.019	0.018	8.65
Butyraldehyde	0.061	0.071	0.071	8.53
C8 aldehydes	0.052	0.047	0.052	5.74
Toluene	0.042	0.037	0.041	6.61
C10 ester	0.228	0.243	0.264	7.38
C11 esters	0.273	0.301	0.328	9.15
Ethyl acetate	0.137	0.120	0.127	6.68
Methyl benzoate	0.260	0.241	0.273	6.24
C10 saturated aliphatic hydrocarbons	0.085	0.078	0.084	4.60
C10 unsaturated aliphatic hydrocarbons	0.074	0.053	0.062	16.7
C11 saturated aliphatic hydrocarbons	0.652	0.577	0.645	6.63
C11 unsaturated aliphatic hydrocarbons	0.078	0.073	0.086	8.30
C12 unsaturated aliphatic hydrocarbons	0.507	0.489	0.550	6.08
C13 saturated aliphatic hydrocarbon	0.018	0.021	0.024	14.3
C13 unsaturated aliphatic hydrocarbons	0.032	0.040	0.044	15.8
Cyclohexane	0.031	0.046	0.055	27.6
Undecane	0.032	0.026	0.032	11.5
3-Buten-2-one	0.027	0.023	0.023	9.49
Acetone	0.267	0.241	0.278	7.25
C8 nitrile	0.221	0.215	0.236	4.83
Isobutyronitrile	0.283	0.246	0.261	7.07
Methacrylonitrile	0.289	0.253	0.276	6.69
Carbon monoxide	0.265	0.262	0.267	0.951
Hexamethylcyclotrisiloxane	0.608	0.543	0.575	5.95
Octamethylcyclotetrasiloxane	0.390	0.377	0.407	3.84
Trimethylsilanol	0.083	0.077	0.074	5.88
Unknown_4	0.021	0.020	0.019	5.00
APRSD				5.91%



# Lab B Material Results Continued

Adhesive tape Component Name ( Unidentified and trace)	1st Conc.(ppm)	2nd Conc.(ppm)	3rd Conc.(ppm)
n-Butyl alcohol	N/A	< 0.020	N/A
Formaldehyde	< 0.100	< 0.100	< 0.100
Valeraldehyde	< 0.017	< 0.017	< 0.017
C8 ether	< 0.010	< 0.010	< 0.010
Butyl chloride	< 0.017	< 0.017	< 0.017
C10 saturated aliphatic hydrocarbon	< 0.007	< 0.007	< 0.007
C10 saturated aliphatic hydrocarbon	< 0.007	< 0.007	N/A
C10 saturated aliphatic hydrocarbon	0.007	< 0.007	< 0.007
C10 saturated aliphatic hydrocarbon	N/A	N/A	0.007
C10 saturated aliphatic hydrocarbon	N/A	< 0.007	N/A
C10 unsaturated aliphatic hydrocarbon	< 0.007	N/A	N/A
C11 unsaturated aliphatic hydrocarbon	< 0.006	< 0.006	< 0.006
C12 saturated aliphatic hydrocarbon	< 0.006	< 0.006	< 0.006
C13 saturated aliphatic hydrocarbon	N/A	< 0.005	< 0.005
C13 saturated aliphatic hydrocarbon	N/A	< 0.005	< 0.005
C13 saturated aliphatic hydrocarbon	< 0.005	N/A	N/A
C14 saturated aliphatic hydrocarbon	< 0.005	N/A	< 0.005
C15 saturated aliphatic hydrocarbon	N/A	N/A	< 0.005
C4 unsaturated aliphatic hydrocarbon	< 0.017	< 0.017	< 0.017
C8 saturated aliphatic hydrocarbon	N/A	N/A	< 0.009
C8 unsaturated aliphatic hydrocarbon	< 0.009	0.012	0.011
C9 saturated aliphatic hydrocarbon	< 0.008	< 0.008	N/A
n-Hexane	< 0.011	< 0.011	N/A
Propylene	< 0.023	N/A	< 0.023
C7 ketone	< 0.011	0.012	0.012
Unknown_1	< 0.014	N/A	N/A
Unknown_2	< 0.014	0.014	N/A
Unknown_3	N/A	N/A	< 0.014
Unknown_5	N/A	N/A	< 0.014
Unknown_6	< 0.014	< 0.014	< 0.014
Unknown_7	N/A	N/A	< 0.014
n-Butyl alcohol	N/A	< 0.020	N/A
Formaldehyde	< 0.100	< 0.100	< 0.100
Valeraldehyde	< 0.017	< 0.017	< 0.017



# Lab C Material Results

CHEMICAL CONTAMINANT	TABLE 1	TABLE 1	TABLE 1
	ug/gm	ug/gm	ug/gm
<b>CALIBRATED COMPOUND</b>			
CARBON MONOXIDE	TRACE	TRACE	TRACE
FORMALDEHYDE	ND	ND	ND
CHLOROMETHANE	0.006	0.009	0.010
METHANOL	3.579	4.444	4.866
ACETALDEHYDE	0.008	TRACE	ND
ETHANOL	0.015	0.015	0.038
PROPENAL	TRACE	TRACE	TRACE
ACETONE	0.046	0.039	0.041
PROPANAL	0.008	0.008	0.006
ISOPROPANOL	0.012	0.015	0.018
2-METHYL-2-PROPANOL	0.283	0.339	0.337
METHYLACETATE	ND	0.005	0.009
N-PROPANOL	TRACE	TRACE	TRACE
2-BUTANONE	0.018	0.014	0.013
ETHYLACETATE	0.061	0.089	0.093
TOLUENE	0.025	0.056	0.090
TRIMETHYLSILANOL	0.025	0.026	0.027
OCTAMETHYLCYCLOTETRAILOXANE	0.218	0.282	0.314
DECAMETHYLCYCLOPENTASILOXANE	0.036	0.035	0.037
HEXAMETHYLCYCLOTRISILOXANE	0.885	1.007	1.189
<b>NON-CALIBRATED COMPOUND</b>			
UNIDENTIFIED FLUORINATED HYDROCARBON	0.024	0.035	0.039
PROPENE	0.014	0.010	0.012
METHOXYTRIMETHYLSILANE	0.007	0.024	0.034
2-METHYL-2-PROPENENITRILE	0.082	0.094	0.093
2-METHYLPROPANENITRILE	0.096	0.110	0.103
C7-ALCOHOL	0.014	0.022	0.025
C10-ALKANE	0.008	0.019	0.025
2-ETHYL-1-HEXANOL	0.032	0.039	0.045
BENZOICACID,METHYLESTER	0.115	0.183	0.215
C14-ALKANE	0.017	0.024	0.030
TOTAL C9-ALKANES	0.012	0.019	0.020
TOTAL C8-ALCOHOLS	0.444	0.526	0.690
TOTAL C11-ALKANES	0.138	0.226	0.279
TOTAL C12-ALKANES	0.269	0.437	0.525
TOTAL C12-ALKENES	0.236	0.400	0.507
TOTAL C13-ALKANES	0.113	0.159	0.186
TOTAL C13-ALKENES	0.351	0.486	0.575
TOTAL C14-ALKENES	0.297	0.372	0.482
<b>TOTAL</b>	<b>7.551</b>	<b>9.626</b>	<b>11.003</b>







# Lab D Material Results

	Gas code	PPM A	PPM B	PPM C
Propane	096750	0.38	0.75	0
Ethanal	020300	0	0.96	0
Methanol	014800	50.2	65	92.2
Acetone	110500	3.92	6.96	0.76
2-Propanol	016400	0.76	10.03	0.49
Carbon disulfide	121000	4.63	1.99	1.44
t-Butanol	012400	3.73	4.77	4.09
Methacrylonitrile	152800	1.41	1.69	1.9
Trimethylsilanol	168500	0.04	0.04	0.05
Isobutyronitrile	152750	1.37	1.65	1.97
Acetic acid	141500	0.44	0.44	0.84
Toluene	035200	1.2	1.78	1.18
Hexamethylcyclotrisiloxane	164500	0	0	0.04
C11 Alcohol	019700	0.88	0.88	0.95
C10 Unsaturated hydrocarbon	099301	4.14	4.91	5.46
C9 Alcohols	019502	5.11	4.33	3.66
C8-C10 Unsaturated aliphatic hydrocarbons	098892	2.1	2.1	2.16
C8 Alcohols	019401	7.87	10.1	9.9
C11 Alcohol	099461	2.42	3.76	1.75
C12 Alcohols	019811	2.44	3.35	1.56
Methyl Benzoate	036300	2.28	2.88	3.44
Unidentified components	999990	7.25	7.88	7.57
C12 Unsaturated aliphatic hydrocarbons	099781	0.84	0.98	0.95
Octyl acetate	043850	8.89	11.21	10.35
Octyl acrylate	045027	5.03	7.29	8.19

## MDL in ppm for traces based on .015 peak area

Tetrahydrofuran	055500	0.17
2-Nonenal	028615	0.19
Benzaldehyde	021200	0.06
2-Propenoic acid	147600	0.38
2-Methyl-1-propene	091350	0.03





# GS-A Shelf Life Results



- GS-A was analyzed by single analysis each time it was returned to WSTF before sending it back out to the next lab.
- Acetonitrile was inconsistent by single analysis. Recommend triplicate analyses for future round robin shelf life studies.

<b>Component Name</b>	<b>Conc. (ppmv)</b>	10/20/11		4/18/12		7/11/12		10/19/12		4/4/13	
		(ppmv)	RPD	(ppmv)	RPD	(ppmv)	RPD	(ppmv)	RPD	(ppmv)	RPD
Vinyl Chloride	10.2	11.11	6.31	11.00	5.56	11.51	9.06	9.73	3.24	10.22	0.12
Acetonitrile	10.4	11.43	7.03	11.63	8.38	20.97	71.86	11.62	8.28	6.83	24.25
Furan	10.4	10.28	0.82	9.09	8.90	9.85	3.76	9.57	5.61	8.80	10.88
Benzene	10.4	10.43	0.18	10.16	1.62	11.93	9.69	10.01	2.66	10.10	2.02

